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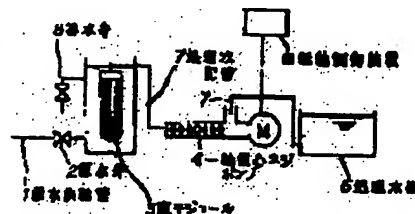
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(54) MEMBRANE FILTER

(57)Abstract:

PURPOSE: To easily and efficiently perform the stages of filtration and washing by a membrane module with one set of water supply pump by sharing a positive displacement screw pump with a pump for filtration and a pump for washing of the external pressure type membrane module.

CONSTITUTION: Raw water is introduced into an external pressure type membrane module 3 through a valve 2 for raw water from a supply pipe 1 therefor. In this case, raw water is passed through the membrane module 5 by a uniaxial eccentric screw pump 4, sucked and introduced into a treated water tank 6 through a pipeline 7 for treated water. The rpm of a motor for the pump 4 is controlled by a signal output from a rotary axis controlling device of the pump in accordance with the flow rate of treated water. When blinding of a filtration film proceeds and filtration resistance is raised to the specified value, the valve 2 for raw water is closed and a drainage valve 9 is opened and the motor of the pump 4 is reversely rotated. In such a way, filtration and washing are easily performed by one set of the positive displacement screw pump.



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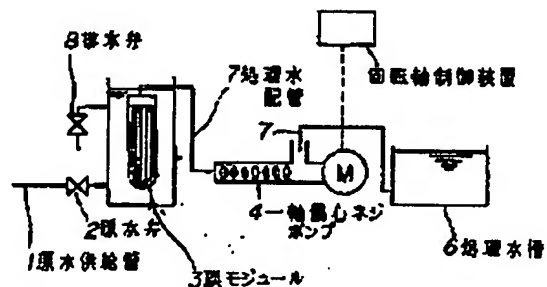
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(54)【発明の名称】 膜透過装置

(57)【要約】

【目的】 膜モジュールを配備した膜透過装置を用いて、装置が簡素で、かつ高効率の透過および洗浄ができる膜透過装置を提供すること。

【構成】 膜モジュールが配備されている膜透過装置を用い、容積ポンプにて透過用ポンプおよび洗浄用ポンプを兼用させること。



【特許請求の範囲】

【請求項1】 槽内に膜モジュールが配備されている膜濾過装置において、容積ネジポンプにて該膜モジュールの濾過用ポンプおよび洗浄用ポンプを兼用させるシステムとすることを特徴とする膜濾過装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は河川水、湖沼水、し尿、用水及び廃水などの原水に含まれる懸濁物を濾過するための膜濾過装置に関する。

【0002】

【従来の技術】 一般に精密濾過膜と称される膜の孔径は、0.01～数 μ mである。これらの孔径を有する精密濾過膜を分類すると膜の外側から内側に液体を濾過する外圧型とその反対に膜の内側から外側に液体を濾過する内圧型とに分類される。

【0003】 外圧型の膜モジュールでは、0.5～2時間濾過継続後、数分間空気を用いてあるいは／および処理水を用いて、膜の内側から外側に、空気洗浄あるいは／および処理水洗浄の洗浄が行われる。また内圧型の膜モジュールでは、濾過と同一または逆の方向に空気あるいは／および処理水でフラッシングによる洗浄が行われる。この時濾過に必要な洗浄媒体に与える膜差圧はポンプによる加圧か、あるいは吸引によって与えるのが一般的である。

【0004】 一般的な工程では、膜濾過を行い次いで処理水洗浄が行われるが、その場合、原水を送水するポンプと洗浄水を送水するポンプが必要である。また当然送水切替のためには弁の設置が必要となる。水温が異なると水の粘性が異なり、濾過膜の面積、濾過膜の種類あるいは濾過差圧などの濾過条件を同一にして膜濾過を行っても得られる処理水量は一定にならず、処理水量を一定にするためには装置中に流量調節機構が必要となる。

【0005】 送水用ポンプとして、通常最も一般的に用いられる、うず巻きポンプを使用した場合には、原水送水に使用する場合においてもまた洗浄に際し洗浄水を送水する場合においても、上記の通り膜の汚染状況や水温の違いなどの理由から膜濾過の圧力損失が異なるため得られる処理水量や必要とする洗浄水量が変動する。これらを一定に保つにはポンプの回転数の制御や水路に定流量弁の設置などの流量調節機構が必要である。

【0006】 また一般的には、外圧型膜モジュールの洗浄において必要な洗浄水量は、処理水量の1～3倍必要である。

【0007】 図2に外圧型濾過膜を用い、加圧ポンプで原水を濾過膜に送水し、処理水を得て、該処理水により濾過膜を洗浄ポンプにより洗浄するシステムのフロー図を示した。詳しくは図において、加圧ポンプ10により原水供給管11から原水を膜モジュール12に原水弁13を介して送水し、原水を濾過して得られた処理水は膜

モジュール12の集水部から処理水配管14に設けた流出弁15と定量弁16（あるいは流量調節弁）を介して処理水槽17に送られる。

【0008】 濾過膜の目詰まりが進んで濾過抵抗が一定値まで上昇した時、加圧ポンプ10を停止し、流出弁15を閉にし、処理水槽17から洗浄用配管18に設けた洗浄弁19および膜モジュール12の排水弁21を開き、洗浄ポンプ22を運転して膜モジュール12を洗浄する。必要とする洗浄水量は定量弁20によって制御される。このように図2に示したシステムでは2台のポンプと6個の弁の設置が必要である。

【0009】 図3には外圧型濾過膜を用い、吸引ポンプで原水を濾過膜に吸引し、処理水を得て、該処理水により濾過膜を洗浄ポンプにより洗浄するシステムのフロー図を示した。図において、吸引ポンプ30により原水供給管31から原水を膜モジュール32に原水弁33を介して送水し、原水を濾過して得られた処理水は膜モジュール32の集水部から処理水配管34に設けた流出弁35と定量弁36（あるいは流量調節弁）を介して処理水槽37に送られる。

【0010】 濾過膜の目詰まりが進んで濾過抵抗が一定値まで上昇した時、吸引ポンプ30を停止し、流出弁35を閉にし、処理水槽37から洗浄用配管38に設けた洗浄弁39および膜モジュール32の排水弁41を開き、洗浄ポンプ42を運転して膜モジュール32を洗浄する。必要とする洗浄水量は定量弁40によって制御される。このように図3に示したシステムでも2台のポンプと6個の弁の設置が必要である。

【0011】

【発明が解決しようとする課題】 本発明は、槽内に膜モジュールが配備されている膜濾過装置において、膜モジュールによる濾過および洗浄の工程を1台の送水ポンプで行い、かつ原水弁および排水弁以外の弁を不要にする、簡素にして効率の良い濾過および洗浄を実現することができる膜濾過装置を提供することにある。

【0012】

【課題を解決するための手段】 上記課題は、少なくとも外圧型膜モジュールが配備されている膜濾過装置において、容積ネジポンプにて該外圧型膜モジュールの濾過用ポンプおよび洗浄用ポンプを兼用させるシステムとすることを特徴とする膜濾過装置によって達成される。

【0013】 本発明に使用する容積ネジポンプは容量式ポンプであるため送水量が一定であり、送水量の変更はポンプの回転数の制御によって行える。またモータは逆回転することが可能で、モータを逆回転することにより送水量の定流量性を保ったまま送水方向が逆になることができる。本発明に使用する容積ネジポンプとしては特に一軸偏心ネジポンプが好ましく利用される。

【0014】 膜モジュールが配備されている膜濾過装置

とは、一般的には放膜透過装置に内圧型膜モジュールや外圧型膜モジュールが用いられ、これら膜透過装置が全体としてその透過および洗浄工程が1台の容積ネジポンプで稼働されてもよいことを意味する。

【0015】河川水、海沼水、し尿、用水及び雨水などの原水に含まれる懸濁物を透過する場合には、膜透過装置をこれら原水槽中に浸漬して吸引方式で原水を膜透過することが有利な膜透過方法であり、従って膜モジュールを原水槽中に浸漬して吸引方式で原水を膜透過することが好ましい態様である。

【0016】外圧型膜モジュールに使用する膜の形式は、中空糸膜でもセラミック膜でも構わない。また膜透過装置は、開放槽に浸漬させて使用するタイプでも密閉ケースに膜を封入したタイプでもよいが、開放槽に浸漬させて使用するタイプが好ましい。開放槽に浸漬させて使用するタイプの場合には、多くの場合送水を吸引方式で行うのが便利である。

【0017】一軸偏心ネジポンプの吸引可能圧が約-8 mAqであるので、本発明において、一軸偏心ネジポンプを使用して行う場合には適用される膜は膜の差圧として0.8 kg/cm²程度以下で透過水が得られるものとする。

【0018】本発明の膜透過装置は活性汚泥法による污水处理にも利用することができ、活性汚泥処理の沈澱池の代わりに利用したり、処理槽に活性汚泥を存在させて生物処理するようにすることもでき、活性汚泥処理工程の効率化をはかることもできる。

【0019】

【実施例】以下、本発明の具体的な実施例を示すが、本発明はこれに限定されるものではない。図1に示した、開放槽に外圧型膜モジュールを浸漬した膜透過装置の図を用いて本発明を説明すると、原水は原水供給管1から原水弁2を経由して外圧型膜モジュール3に導入される。一軸偏心ネジポンプ4により原水は外圧型膜モジュール3を通過して吸引され処理水配管7を通過して処理水槽6に流入する。処理水の流量はポンプの回転数制御装置からの信号で一軸偏心ネジポンプ4のモータの回転数を制御して行う。

【0020】透過膜が目詰まりが進んで透過抵抗が一定値まで上昇した時、処理水による透過膜の洗浄は原水弁2を閉じ、排水弁9を開として一軸偏心ネジポンプ4のポンプを逆回転させて行う。この時洗浄水は処理水槽6より処理水配管7を通過して外圧型膜モジュール3に送られ、膜内部から外部へ通過し、排水弁8を通過して排水される。この洗浄水量は今より回転数制御装置からの信号で一軸偏心ネジポンプ4のモータの回転数を制御して行う。

【0021】必要な洗浄水量は、処理水量の1~3倍必要であるので洗浄時一軸偏心ネジポンプ4のモータの回転数は透過時よりも高くするように制御する。

【0022】

【発明の効果】本発明は膜透過装置に容積ネジポンプとその回転数の制御を行う制御器とを組み込むことにより、透過と洗浄とを1台の容積ネジポンプを用いて行い、従来の透過装置に組み込まれていた原水送水ポンプや洗浄水供給ポンプの2台のポンプが1台で済み、さらに処理水排水弁、定流量弁や洗浄弁などの4個の弁を不要にでき、膜透過装置と処理水槽を容積ネジポンプを介して1本の配管で連絡できるので装置として従来方式に比べて極めてシンプルになり、メンテナンスが大幅に軽減された。

【図面の簡単な説明】

【図1】図1は本発明の開放槽に外圧型膜モジュールを浸漬した膜透過装置を一軸偏心ネジポンプとその回転制御装置によって操作して透過を行う工程フロー図。

【図2】図2は加圧ポンプと洗浄用ポンプを使用し、弁により透過や洗浄を制御する従来の膜透過装置の工程フロー図。

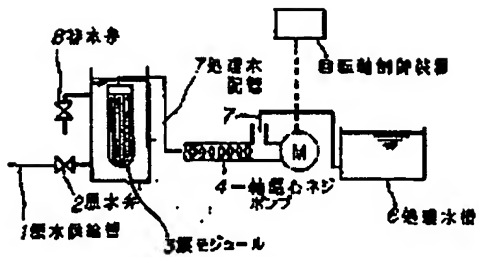
【図3】図3は吸引ポンプと洗浄用ポンプを使用し、弁により透過や洗浄を制御する従来の膜透過装置の工程フロー図。

【符号の説明】

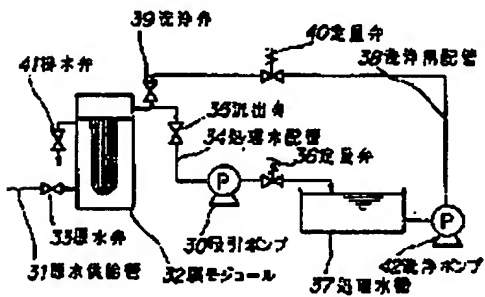
- 1 原水供給管
- 2 原水弁
- 3 膜モジュール
- 4 一軸偏心ネジポンプ
- 6 処理水槽
- 7 処理水配管
- 8 排水弁
- 10 加圧ポンプ
- 11 原水供給管
- 12 膜モジュール
- 13 原水弁
- 14 処理水配管
- 15 流出弁
- 16 定流量弁
- 17 処理水槽
- 18 洗浄用配管
- 19 洗浄弁
- 20 定流量弁
- 21 排水弁
- 22 洗浄ポンプ
- 30 吸引ポンプ
- 31 原水供給管
- 32 膜モジュール
- 33 原水弁
- 34 処理水配管
- 35 流出弁
- 36 定流量弁
- 37 処理水槽

38 洗浄用配管
39 洗浄弁
40 定量弁

【図1】



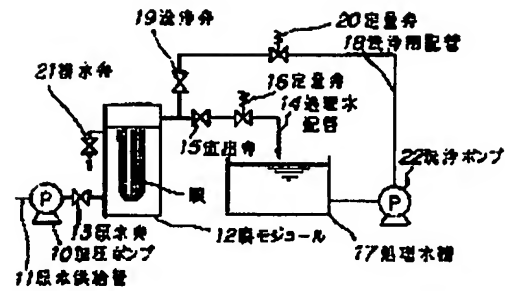
【図3】



* 41 排水弁
42 洗浄ポンプ

*

【図2】



(19) Japanese Patent Office (JP)

(12) Kokai Unexamined Patent Application Bulletin (A)

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	F04C 2/107		8311-3H		

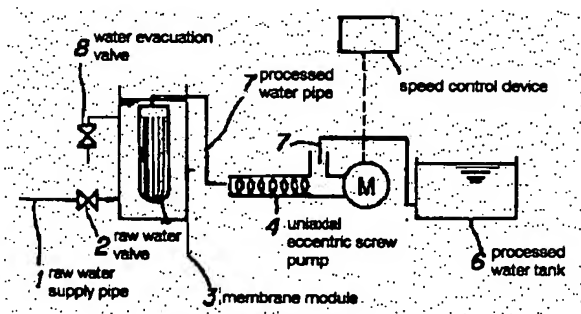
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(54) Title of the Invention: Membrane Filter Device

(57) [Abstract]

[Object] To provide a membrane filter device whereby, using a membrane filter device wherein a membrane module is provided, the equipment is [made] simple and highly efficient filtration and washing are possible.

[Constitution] Using a membrane filter device wherein a membrane module is provided, a positive displacement screw pump serves jointly as a filtration pump and a washing pump.



[CLAIMS]

[Claim 1] In a membrane filter device wherein a membrane module is provided in a tank, the membrane filter device characterized by a system wherein a positive displacement screw pump is used jointly as a filtration pump and a washing pump for said membrane module.

[Detailed Description of the Invention]**[0001]**

[Field of Industrial Application] The present invention relates to a membrane filtration device for filtering suspensions contained in raw water such as river water, lake water, human waste water, industrial water and effluent.

[0002]

[Prior Art] The pores of membranes commonly referred to as precision filtration membranes have the diameters from 0.1 μm to several μm . Precision filtration membranes with these pore sizes can be classified into the external-pressure type, for filtering liquid from the exterior of the membrane to the interior thereof, and the internal-pressure type, for conversely filtering liquid from the interior of the membrane to the exterior thereof.

[0003] With external-pressure membrane modules, after continuous filtration for 0.5 to 2 hours, air washing and/or processed-water washing is performed for several minutes from the interior of the membrane to the exterior thereof, using air and/or processed water. Furthermore, with the internal-pressure type membrane modules, washing is performed by flushing with air and/or processed water in the same direction as filtration or in the opposite direction. Generally, at this time, the membrane pressure differential applied to the washing medium that is necessary for filtering is applied by way of pressurization with a pump or by way of suction.

[0004] The general procedure is one wherein membrane filtration is performed, and then processed water washing is performed; but in this case, a pump for feeding raw water and a pump for feeding washing water are necessary. It is also a matter of course that valves must be provided for switching the water feeds. The viscosity of water differs at different temperatures, and even if membrane filtration is performed under identical filtration conditions, such as the same filter-membrane surface area, the same type of filter membrane, or the same filter pressure differential, the flow of processed water produced is not constant, and in order to achieve a constant flow of processed water, the device must include a flow-rate control mechanism.

[0005] If a centrifugal pump, which is the most commonly used, is used for the water feed pump, whether this is used for feeding raw water, or used for feeding washing water when washing, because of differences in the pressure drop across the membrane caused by differences in the degree of soiling of the membrane and water temperature, as described above, the flow of processed water produced and the required washing water flow will vary. In order to maintain these [volumes] constant, flow-rate control mechanisms, such as that of controlling the pump speed or that of providing constant flow valves on the water lines, are necessary.

[0006] Furthermore, in general, the washing water flow necessary for washing external-pressure membrane modules is 1-3 times the processed water flow.

[0007] FIG. 2 shows a flowchart for a system wherein an external-pressure filter membrane is used and raw water is fed to the filter membrane by a pressure pump to produce processed water, and wherein the filter membrane is washed by this processed water, using a washing pump. More specifically, in the drawing, raw water is fed to a membrane module 12, by way of a raw water valve 13, from a raw water supply pipe 11, using a pressure pump 10, and the processed

water produced by filtering the raw water is sent from the intake of the membrane module 12 to a processed water tank 17, by way of an outflow valve 15 and a constant flow valve 16 (or a flow-rate control valve), which are provided on a processed water pipe 14.

[0008] When filter resistance rises to a predetermined value as a result of progressive clogging of the filter membrane, the pressure pump 10 is stopped, the outflow valve 15 is closed, the washing valve 19 provided on the washing pipe 18 [leading] from the processed water tank 17 and the water evacuation valve 21 for the membrane module 12 are opened, the washing pump 22 is operated and the membrane module 12 is washed. The required washing water flow is controlled by the constant flow valve 20. Thus, the system shown in FIG. 2 requires the provision of two pumps and six valves.

[0009] FIG. 3 shows a flowchart for a system wherein an external-pressure filter membrane is used and raw water is suctioned to the filter membrane by a suction pump to produce processed water, and wherein the filter membrane is washed by this processed water, using a washing pump. In the drawing, raw water is sent from a raw water supply pipe 31 to a membrane module 32, by way of a raw water valve 33, using a suction pump 30, and processed water produced by filtering the raw water is sent from the intake of the membrane module 32 to a processed water tank 37 by way of an outflow valve 35 and a constant flow valve 36 (or flow-rate control valve), which are provided on a processed water pipe 34.

[0010] When filter resistance rises to a predetermined value as a result of progressive clogging of the filter membrane, the suction pump 30 is stopped, the outflow valve 35 is closed, the washing valve 39 provided on the washing pipe 38 [leading] from the processed water tank 37 and the water evacuation valve 41 on the membrane module 32 are opened, the washing pump 42 is operated, and the membrane module 32 is washed. The required washing water flow is controlled by the constant flow valve 40. Thus, the system shown in FIG. 3 also requires the provision of two pumps and six valves.

[0011]

[Problems to Be Solved by the Invention] The present invention lies in providing a membrane filter device wherein, in a membrane filter device wherein a membrane module is provided in a tank, the processes of filtration by way of the membrane module and washing are performed by a single water pump, and wherein valves other than a raw water valve and a water evacuation valve are not needed, thus allowing realization of simple and efficient filtration and washing.

[0012]

[Means for Solving the Problems] The object described above is achieved by way of, in a membrane filter device wherein at least an external-pressure membrane module is provided, the membrane filter device characterized by a system wherein a positive displacement screw pump is used jointly as a filtration pump and a washing pump for said membrane module.

[0013] Because the positive displacement screw pump used in the present invention is a displacement pump, the flow is constant and the pumping rate can be changed by controlling the speed of the pump. Furthermore, the motor can be reversed, and by reversing the motor the water feed direction can be reversed, while maintaining constant flow characteristics for the pumping rate, meaning that this can be used as both a filter pump and a washing pump. It is particularly preferred that a uniaxial eccentric screw pump be used as the positive displacement screw pump employed in the

present invention.

[0014] The term "membrane filter device wherein a membrane module is provided" generally refers to the use of an internal-pressure membrane module or an external-pressure membrane module as the membrane filter device, the filtration and the washing of the overall membrane filter device being performed by a single positive displacement screw pump.

[0015] When filtering suspensions contained in raw water such as river water, lake water, human waste water, industrial water and effluent, an effective membrane filtration method is to immerse the membrane filter device in tanks of such raw water and subject the raw water to membrane filtration by way of suction; accordingly, suction-type membrane filtration by way of immersing a membrane module in a raw water tank is a preferred mode.

[0016] In terms of the form of the membrane used for an external-pressure membrane module, this may be either a hollow fiber membrane or a ceramic membrane. Furthermore, the membrane filter device may be of the type used by immersion in an open tank, or of the type wherein the membrane is sealed in a closed case, but the type used by immersion in an open tank is preferred. In the case of the type used by immersion in an open tank, it is often convenient for water feed to be performed by way of suction.

[0017] The suction pressure capacity of a uniaxial eccentric screw pump is approximately -8 mEq, and therefore, if a uniaxial eccentric screw pump is used for the present invention, suitable membranes are membranes capable of producing permeate at a membrane pressure differential of no greater than approximately 0.8 kg/cm².

[0018] The membrane filter device of the present invention can also be used for sludge processing by way of the activated sludge method; it can be used in place of a sedimentation pond for activated sludge processing and can be such that activated sludge is caused to be present in a processing tank so as to perform biological processing; this can be expected to increase the efficiency of the activated sludge treatment process.

[0019]

[Embodiments] Hereinafter, specific embodiments of the present invention are set forth, but the present invention is not limited thereby. The present invention is described by way of a drawing of a membrane filter device wherein an external-pressure membrane module is immersed in an open tank, as shown in FIG. 1, wherein raw water is fed from a raw water supply pipe 1 to an external-pressure membrane module 3, by way of a raw water valve 2. The raw water is suctioned through the external-pressure membrane module 3 by way of a uniaxial eccentric screw pump 4 and caused to flow into a process tank [sic] 6, by way of a processed water pipe 7. The flow rate of the processed water is [controlled] by controlling the speed of a motor for the uniaxial eccentric screw pump 4 by a signal from a pump speed control device.

[0020] When filter resistance rises to a predetermined value as a result of progressive clogging of the filter membrane, washing of the filter membrane with processed water is performed by closing a raw water valve 2, opening a water evacuation valve 9 [sic] and running the uniaxial eccentric screw pump 4 in reverse. At this time, the washing water is sent from the processed water tank 6 to the external-pressure membrane module 3, by way of the processed water pipe 7, permeates from the interior of the membrane to the exterior thereof, and is evacuated by way of a water evacuation valve 8. The flow rate of the washing water is also [controlled] by controlling the speed of the motor of the uniaxial eccentric screw pump 4 by a signal from the pump speed control device.

[0021] Because the required washing water flow is 1-3 times the processed water flow, the motor of the uniaxial eccentric screw pump 4 is controlled [so as to run] faster during washing than during filtering.

[0022]

[Effects of the Invention] In the present invention, by combining a positive displacement screw pump and a controller for controlling the speed thereof, filtration and washing are performed using one positive displacement screw pump, thus eliminating one of the two pumps (raw water feed pump and washing water feed pump) that are included in conventional filter devices; furthermore, four valves, including the processed water flow valve, the constant flow valves, and the washing valve, are made unnecessary; the membrane filter device and the processed water tank can be connected by one pipe, by way of the positive displacement screw pump, which results in a device that is much simpler than conventional systems; and maintenance is greatly reduced.

[Brief Description of the Drawings]

[FIG. 1] FIG. 1 is a process flowchart for filtration wherein a membrane filter device having an external-pressure membrane module immersed in an open tank is operated by way of a uniaxial eccentric screw pump and a speed control device therefor.

[FIG. 2] FIG. 2 is a process flowchart of a conventional membrane filter device using a pressure pump and a washing pump, and controlling filtration and washing by way of valves.

[FIG. 3] FIG. 3 is a process flowchart of a conventional membrane filter device using a suction pump and a washing pump, and controlling filtration and washing by way of valves.

[Explanation of the Reference Numerals]

- 1 raw water supply pipe
- 2 raw water valve
- 3 membrane module
- 4 uniaxial eccentric screw pump
- 6 processed water tank
- 7 processed water pipe
- 8 water evacuation valve
- 10 pressure pump
- 11 raw water supply pipe
- 12 membrane module
- 13 raw water valve
- 14 processed water pipe
- 15 outflow valve
- 16 constant flow valve
- 17 processed water tank
- 18 washing pipe
- 19 washing valve
- 20 constant flow valve
- 21 water evacuation valve
- 22 washing pump
- 30 suction pump
- 31 raw water supply pipe
- 32 membrane module
- 33 raw water valve
- 34 processed water pipe
- 35 outflow valve
- 36 constant flow valve
- 37 processed water tank

- 38 washing pipe
39 washing valve
40 constant flow valve

- 41 water evacuation valve
42 washing pump

FIG. 1

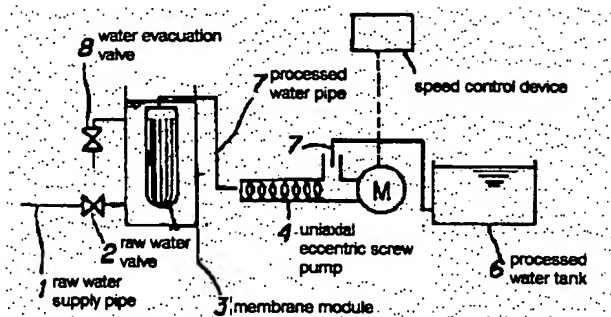


FIG. 2

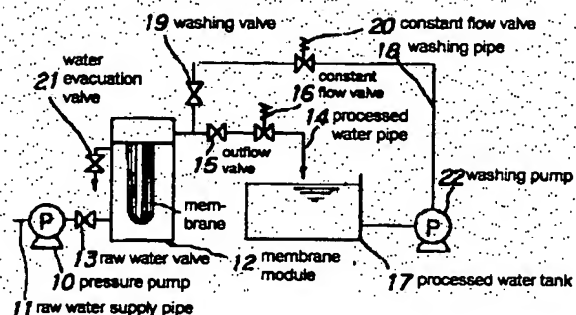


FIG. 3

